

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>		1. CONTRACT ID CODE		PAGE OF PAGES 1 2	
2. AMENDMENT/MODIFICATION NO. 001		3. EFFECTIVE DATE 08/09/2013		4. REQUISITION/PURCHASE REQ. NO.	
5. PROJECT NO. (If applicable) C.2.2.3.04		6. ISSUED BY CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268		7. ADMINISTERED BY (If other than Item 6) CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code) BATTELLE MEMORIAL INSTITUTE 505 KING AVE COLUMBUS OH 432012693		(x)		9A. AMENDMENT OF SOLICITATION NO.	
				9B. DATED (SEE ITEM 11)	
		X		10A. MODIFICATION OF CONTRACT/ORDER NO. EP-C-11-038 0007	
				10B. DATED (SEE ITEM 13) 08/24/2012	
CODE (b)(4)		FACILITY CODE			

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☐ is not extended.  
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)  
See Schedule

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
X	D. OTHER (Specify type of modification and authority) Mutual Agreement between the Parties and Battelle's letter dated July 23, 2013

E. IMPORTANT: Contractor ☒ is not. ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

DUNS Number: (b)(4)

The purposes of this modification are to: extend the Task Order Period of Performance until December 31, 2013; and to change the Task Order Manager/Alternate Task Order Manager.

These are No Cost changes.

TOPO: Lukas Oudejans

LIST OF CHANGES:

Reason for Modification : Other Administrative Action

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Camille W. Davis	
15B. CONTRACTOR/OFFEROR  (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA  (Signature of Contracting Officer)	16C. DATE SIGNED 08/09/2013

<b>CONTINUATION SHEET</b>	REFERENCE NO. OF DOCUMENT BEING CONTINUED	PAGE	OF
	EP-C-11-038/0007/001	2	2

NAME OF OFFEROR OR CONTRACTOR  
 BATTELLE MEMORIAL INSTITUTE

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Period of Performance End Date changed From: August 26, 2013 To: December 31, 2013  TOCOR (Task Order Contracting Officer's Representative) changed From: Emily Snyder To : Lukas Oudejans  Alternate COR/Project Officer changed From: Lukas Oudejans To: Emily Snyder Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center Mail Drop D143-02 109 TW Alexander Drive Durham NC 27711 Period of Performance: 08/24/2012 to 12/31/2013				

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE		PAGE OF PAGES 1 8		
2. AMENDMENT/MODIFICATION NO. 002		3. EFFECTIVE DATE See Block 16C		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. (If applicable) C.2.2.3.04	
6. ISSUED BY CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268		7. ADMINISTERED BY (If other than Item 6) CPOD		7. ADMINISTERED BY (If other than Item 6)		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)  BATTELLE MEMORIAL INSTITUTE 505 KING AVE COLUMBUS OH 432012693				(x) 9A. AMENDMENT OF SOLICITATION NO.			
				9B. DATED (SEE ITEM 11)			
				X 10A. MODIFICATION OF CONTRACT/ORDER NO. EP-C-11-038 0007			
				10B. DATED (SEE ITEM 13) 08/24/2012			
CODE (b)(4)		FACILITY CODE					

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12. ACCOUNTING AND APPROPRIATION DATA (If required)  
See Schedule

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
X	D. OTHER (Specify type of modification and authority) Mutual Agreement between the Parties and Battelle's proposal dated August 23, 2013

**E. IMPORTANT:** Contractor ☒ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

DUNS Number: (b)(4)

The purpose of this modification is to incorporate revisions to the Task Order PWS as highlighted. There are no additional costs for these changes and the performance period remains the same.

TOPO: Lukas Oudejans

LIST OF CHANGES:

Reason for Modification : Additional Work--PWS revisions.

The PWS revisions are No Cost changes. Task Order Period of Performance remains the same.

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Camille W. Davis	
15B. CONTRACTOR/OFFEROR  (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA  (Signature of Contracting Officer)	16C. DATE SIGNED 09/03/2013

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED  
EP-C-11-038/0007/002PAGE OF  
2 8NAME OF OFFEROR OR CONTRACTOR  
BATTELLE MEMORIAL INSTITUTE

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center Mail Drop D143-02 109 TW Alexander Drive Durham NC 27711 Period of Performance: 08/24/2012 to 12/31/2013				

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE		PAGE OF PAGES 1 2		
2. AMENDMENT/MODIFICATION NO. 003		3. EFFECTIVE DATE See Block 16C		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. (If applicable) C.2.2.3.04	
6. ISSUED BY CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268		7. ADMINISTERED BY (If other than Item 6) CPOD		7. ADMINISTERED BY (If other than Item 6)		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code) BATTELLE MEMORIAL INSTITUTE 505 KING AVE COLUMBUS OH 432012693				(x) 9A. AMENDMENT OF SOLICITATION NO.		9B. DATED (SEE ITEM 11)	
CODE (b)(4) FACILITY CODE				X 10A. MODIFICATION OF CONTRACT/ORDER NO. EP-C-11-038 0007		10B. DATED (SEE ITEM 13) 08/24/2012	

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12. ACCOUNTING AND APPROPRIATION DATA (If required)  
See Schedule

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	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
X	D. OTHER (Specify type of modification and authority) Mutual Agreement between the Parties and Battelle's letter dated October 16, 2013.

**E. IMPORTANT:** Contractor ☒ is not. ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

**14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)**

DUNS Number: (b)(4)

The purpose of this modification is to extend the Task Order period of performance through January 31, 2014. This is a No Cost extension.

TOPO: Lukas Oudejans

LIST OF CHANGES:

Reason for Modification: No Cost Extension

Period Of Performance End Date changed

From: December 31, 2014

To: January 31, 2014

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Camille W. Davis	
15B. CONTRACTOR/OFFEROR  (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA  (Signature of Contracting Officer)	16C. DATE SIGNED 11/22/2013

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED  
EP-C-11-038/0007/003PAGE OF  
2 2NAME OF OFFEROR OR CONTRACTOR  
BATTELLE MEMORIAL INSTITUTE

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Delivery Location Code: ORD NHSRC DCMD US Environmental Protection Agency US EPA 4930 Old Page Road Room #: E311G Durham NC 27703 USA  Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive Durham NC 27711 FOB: Destination Period of Performance: 08/24/2012 to 01/31/2014				

## AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE

PAGE OF PAGES

1

2

2. AMENDMENT/MODIFICATION NO.

004

3. EFFECTIVE DATE

08/15/2014

4. REQUISITION/PURCHASE REQ. NO.

5. PROJECT NO. (If applicable)

6. ISSUED BY

CODE

CPOD

7. ADMINISTERED BY (If other than Item 6)

CODE

CPOD

US Environmental Protection Agency

26 West Martin Luther King Drive

Mail Code: NWD

Cincinnati OH 45268

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)

(x)

9A. AMENDMENT OF SOLICITATION NO.

9B. DATED (SEE ITEM 11)

10A. MODIFICATION OF CONTRACT/ORDER NO.

EP-C-11-038

0007

10B. DATED (SEE ITEM 13)

08/24/2012

CODE (b)(4)

FACILITY CODE

## 11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

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12. ACCOUNTING AND APPROPRIATION DATA (If required)

Net Decrease:

-\$11,323.46

See Schedule

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CHECK ONE

A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER (Specify type of modification and authority)

X Limitation of Funds Notice

E. IMPORTANT: Contractor ☒ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

DUNS Number: (b)(4)

The purpose of this modification is to de-obligate funding in conjunction with the Unliquidated Obligations exercise.

TOPO: Lukas Oudejans

LIST OF CHANGES:

Reason for Modification : Funding Only Action

Incremental Funded Amount changed

From: \$305,141.00

To: \$293,817.54

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)

16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)

Camille W. Davis

15B. CONTRACTOR/OFFEROR

15C. DATE SIGNED

16C. DATE SIGNED

(Signature of person authorized to sign)

Camille W. Davis

ELECTRONIC  
SIGNATURE

08/15/2014

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED  
EP-C-11-038/0007/004

PAGE 2 OF 2

NAME OF OFFEROR OR CONTRACTOR  
BATTELLE MEMORIAL INSTITUTE

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	<p>CHANGES FOR LINE ITEM NUMBER: 1 Obligated Amount for this modification: -\$11,323.46 Incremental Funded Amount changed from \$305,141.00 to \$293,817.54</p> <p>CHANGES FOR ACCOUNTING CODE: 12-13-C3-264B000-401F72-2532-HQ00BG00-12264BE032-0 01 Amount changed from \$300,000.00 to \$288,676.54</p> <p>The Revised Task Order funding break-out is as follows:</p> <p>Cost: \$(b)(4) Fee: \$ Total: \$293,817.54</p> <p>Delivery Location Code: ORD NHSRC DCMD US Environmental Protection Agency US EPA 4930 Old Page Road Room #: E311G Durham NC 27703 USA</p> <p>Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive Durham NC 27711</p> <p>FOB: Destination Period of Performance: 08/24/2012 to 01/31/2014</p>				

# ORDER FOR SUPPLIES OR SERVICES

PAGE OF PAGES

1 12

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER 08/24/2012		2. CONTRACT NO. (If any) EP-C-11-038		6. SHIP TO: a. NAME OF CONSIGNEE US Environmental Protection Agency				
3. ORDER NO. 0007		4. REQUISITION/REFERENCE NO. See Schedule						
5. ISSUING OFFICE (Address correspondence to) CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268				b. STREET ADDRESS US EPA 4930 Old Page Road Room #: E311G		c. CITY Durham		
				d. STATE NC		e. ZIP CODE 27703		
7. TO: a. NAME OF CONTRACTOR BATTELLE MEMORIAL INSTITUTE				f. SHIP VIA				
b. COMPANY NAME				8. TYPE OF ORDER				
c. STREET ADDRESS 505 KING AVE				<input type="checkbox"/> a. PURCHASE REFERENCE YOUR:		<input checked="" type="checkbox"/> b. DELIVERY Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.		
d. CITY COLUMBUS		e. STATE OH		f. ZIP CODE 432012693		Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.		
9. ACCOUNTING AND APPROPRIATION DATA See Schedule				10. REQUISITIONING OFFICE CPOD				
11. BUSINESS CLASSIFICATION (Check appropriate box(es))							12. F.O.B. POINT Destination	
<input type="checkbox"/> a. SMALL <input checked="" type="checkbox"/> b. OTHER THAN SMALL <input type="checkbox"/> c. DISADVANTAGED <input type="checkbox"/> d. WOMEN-OWNED <input type="checkbox"/> e. HUBZone <input type="checkbox"/> f. SERVICE-DISABLED VETERAN-OWNED <input type="checkbox"/> g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM <input type="checkbox"/> h. EDWOSB								
13. PLACE OF		14. GOVERNMENT B/L NO.		15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date)		16. DISCOUNT TERMS		
a. INSPECTION Destination		b. ACCEPTANCE Destination						
17. SCHEDULE (See reverse for Rejections)								
ITEM NO. (a)	SUPPLIES OR SERVICES (b)			QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	DUNS Number: (b)(4) Systematic Decontamination of Lewisite - Neutralization and Arsenic Removal TOPO: Emily Snyder  Continued ...							
18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.				17(h) TOTAL (Cont. ages)
21. MAIL INVOICE TO:								
a. NAME RTP Finance Center						\$0.00		
b. STREET ADDRESS (or P.O. Box) US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive								17(i) GRAND TOTAL
c. CITY Durham				d. STATE NC	e. ZIP CODE 27711		\$305,141.00	
22. UNITED STATES OF AMERICA BY (Signature)				23. NAME (Typed) Camille W. Davis TITLE: CONTRACTING/ORDERING OFFICER				

**ORDER FOR SUPPLIES OR SERVICES**  
**SCHEDULE - CONTINUATION**

PAGE NO

2

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER

CONTRACT NO.

ORDER NO.

08/24/2012

EP-C-11-038

0007

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
0001	<p>Admin Office: CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268 Period of Performance: 08/24/2012 to 08/26/2013</p> <p>Incremental funding of EP-C-11-038 Award Type: Cost-plus-fixed-fee Total Estimated Cost: \$(b)(4) Fixed Fee: \$(b)(4) Completion Form Requisition No: PR-ORD-12-01429, PR-ORD-12-03127</p> <p>Accounting Info: 12-13-C3-264B000-401F72-2532-HQ00BG00-12264BE032-001 BFY: 12 EFY: 13 Fund: C3 Budget Org: 264B000 Program (PRC): 401F72 Budget (BOC): 2532 Job #: HQ00BG00 DCN - Line ID: 12264BE032-001 Funding Flag: Partial Funded: \$300,000.00</p> <p>Accounting Info: 12-13-C-264B000-401F72XPC-2532-12264BE064-001 BFY: 12 EFY: 13 Fund: C Budget Org: 264B000 Program (PRC): 401F72XPC Budget (BOC): 2532 DCN - Line ID: 12264BE064-001 Funding Flag: Partial Funded: \$5,141.00</p> <p>The obligated amount of award: \$305,141.00. The total for this award is</p>					

TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))

\$0.00

***PERFORMANCE WORK STATEMENT***  
***SYSTEMATIC DECONTAMINATION OF LEWISITE – NEUTRALIZATION AND ARSENIC REMOVAL***

**OMIS C.2.2.3.04**

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Field Code Changed

**PERFORMANCE WORK STATEMENT  
STREAMS II  
Task Order 0007, Battelle EP-C-11-038**

<b>Task Order Manager (TOM)</b>	<b>Alternate Task Order Manager (ATOM)</b>
Name: Emily Snyder	Name: Lukas Oudejans
Office: ORD/NHSRC/DCMD 10 TW Alexander Dr, MD E343-06 Durham, NC 27711	Office: ORD/NHSRC/DCMD 10 TW Alexander Dr, MD E343-06 Durham, NC 27711
Phone: (919) 541-1006	Phone: (919) 541-2973
Fax: (919) 541-0496	Fax: (919) 541-0496
Email: <a href="mailto:Snyder.Emily@epa.gov">Snyder.Emily@epa.gov</a>	Email: <a href="mailto:Oudejans.Lukas@epa.gov">Oudejans.Lukas@epa.gov</a>

**I. TITLE** Systematic Decontamination of Lewisite – Neutralization and Arsenic Removal

**II. PERIOD OF PERFORMANCE:** August 24, 2012 through August 26, 2013

**I. SUMMARY OF OBJECTIVES**

This work shall provide the efficacies of various developmental and commercially available methods for chemical agent decontamination. Currently there are few known decontaminants for neutralization of Lewisite (conversion to a non-vesicant compound). Current literature states that bleach is effective but only solution-based data is referenced. The efficacy of bleach and other surface decontaminants against Lewisite deposited onto surfaces typically found in civilian facilities is unknown. This task order shall cover the evaluation of liquid, gel or foam based decontaminants for decontamination of Lewisite on interior building materials and evaluation of two methods for removal of arsenic after neutralization of the Lewisite.

**II. RELEVANCE**

The imminent threat of a chemical agent release in a building or transportation hub is driving the US EPA's National Homeland Security Research Center (NHSRC) Decontamination and Consequence Management Division (DCMD) to develop a research program that systematically evaluates potential decontaminants of chemical agents. The US EPA may be tasked to cleanup these agents after they are released and it is unknown how effective many of these available technologies are against chemical agents. In this work, the efficacy of a set of decontamination technologies and one arsenic removal technology shall be systematically evaluated and the effect of these decontaminants on the building material shall also be accessed qualitatively.

**III. BACKGROUND**

Protecting human health and the environment from the release of hazardous materials is the mission of the US EPA. During recent construction of the National Response Team (NRT) Quick Reference Guides, NHSRC scientists discovered there is a lack of data on the persistence of Lewisite and on decontamination of Lewisite contaminated surfaces. Current literature states

that Lewisite is relatively non-persistent, but no systematic work has been completed on its persistence on surfaces. All decontaminants must be able to neutralize the three different compounds that comprise Lewisite: L-1 (2-chlorovinyl-dichloroarsine, Lewisite); L-2 (di-(2-chlorovinyl)-chloroarsine); and L-3 (tris-(2-chlorovinyl)-arsine). In addition to converting the Lewisite to non-vesicant compounds, all decontamination operations must also consider how to remove the remaining arsenic.

#### **IV. SCOPE**

The overall objective of this work is to evaluate three (3) surface decontaminants for neutralization of Lewisite on three (3) different surfaces. For a subset of these coupons, the ability of one arsenic removal technology shall be tested. Prior to performing decontamination and removal experiments, method development regarding analysis of Lewisite and extraction of Lewisite and arsenic from the surfaces shall be required.

#### **V. TECHNICAL APPROACH**

The contractor shall perform a series of solution-based decontamination tests and surface-based decontamination tests. One removal technology for the remaining arsenic of the decontaminated coupons shall be assessed. Prior to these tests, method development shall be completed on the extraction and analysis of Lewisite and extraction of total arsenic. The Lewisite analysis of the extracts shall include analysis of all forms of Lewisite (L-1 (2-chlorovinyl-dichloroarsine, Lewisite), L-2 (di-(2-chlorovinyl)-chloroarsine), and L-3 (tris-(2-chlorovinyl)-arsine). The contractor shall also include the option to analyze the vesicant degradation/decontamination by-products (2-chlorovinylarsenous acid and Lewisite oxide) in Tasks 1, 2, and 3 as a separate cost estimate. These tasks are discussed in more detail in the Section VIII.

#### **TASKS - SYSTEMATIC DECONTAMINATION OF LEWISITE - NEUTRALIZATION AND ARSENIC REMOVAL**

##### **TASK 1: DRAFT A QUALITY ASSURANCE PLAN**

The contractor shall draft a Quality Assurance (QAP) plan that shall cover the work outlined in this PWS including a project timeline. This QA plan shall follow guidelines set forth in Attachment #1 to the PWS. In this plan, the test matrices must include laboratory blanks, positive controls, and procedural blanks in addition to the test coupons. The test/QA plan shall be submitted to the EPA Task Order Manager (TOM) and approved by the EPA QA Manager prior to initiating the test matrix.

##### **TASK 2: METHOD DEVELOPMENT FOR LEWISITE AND TOTAL ARSENIC**

To develop the method for extraction and analysis of Lewisite, the contractor shall review publicly-available information and unclassified military methods for extraction and analysis of Lewisite from materials such as glass, wood, concrete, and metal. Analysis methods shall likely be liquid chromatography/mass spectrometry and gas chromatography/mass spectrometry. In addition, the analytes may require derivatization prior to analysis. During this literature search, the contractor shall also

identify methods for analysis of toxic by-products that may be formed when in contact with materials or as a result of decontamination.

From the outputs of the literature search, the contractor shall select up to three (3) solvents to test extraction efficiency. The analysis shall be determined from the literature search mentioned above. For each material, the extraction efficiency of these three solvents shall be evaluated in triplicate. Extraction efficiencies of 40%-120% with less than a 30% coefficient of variance between samples are deemed acceptable. This task shall generate up to 36 test coupon extracts, plus nine (9) positive controls and laboratory blanks.

Under this task method, detection limit studies for Lewisite on the three materials shall also be completed. These studies shall follow the single concentration design estimator recommended by the EPA (40 CFR part 136, Appendix B (1984)). When these studies are conducted, the agent shall not be diluted in solvent.

To determine a method for extraction of total arsenic from these same surfaces, the contractor shall consult with the EPA TOM to select two (2) extraction solvents for evaluation for extraction of arsenic from all three materials. For each material, the extraction efficiency of these two solvents shall be evaluated in triplicate. Extraction efficiencies of 40%-120% with less than a 30% coefficient of variance between samples are deemed acceptable. This task shall generate 18 test coupon extracts plus laboratory blanks. The contractor shall use ICP-MS (EPA Method 200.8) or graphite furnace atomic absorption (EPA Method 200.9) to determine total arsenic in the extracts.

### **TASK 3: PERFORM DECONTAMINATION EFFICACY TESTS**

Prior to performing surface decontamination testing, a set of solution-based tests shall be conducted. Four (4) decontamination solutions representing a range of potential decontamination chemistries (acidic and alkaline hydrolysis, oxidation, etc.) shall be tested against Lewisite in solution for one (1) reaction time (TBD upon consultation with EPA TOM). This test matrix shall be conducted in triplicate with three (3) positive controls yielding a total of 12 samples for analysis in addition to the laboratory blanks.

One of the most important variables in the surface decontamination testing is the building material properties. The contractor shall perform tests on the following porous and non-porous building material coupons: sealed concrete; wood flooring material; and galvanized metal ductwork. The size of the building material coupons shall be 3.5 by 1.5 cm and other characteristics (such as brand, lot number, ASTM No.) of the building material coupons shall be provided by the EPA TOM. The contractor shall procure and prepare the coupons. The Lewisite shall be applied as a liquid either as one droplet or a series of droplets. The exact procedure shall be determined in consult with the TOM.

A test matrix for the surface decontamination testing is shown in Table 1. At least five (5) replicates of the test coupons, three (3) replicates of the positive controls, and two (2) replicates of procedural blanks at each of the contact times shall be analyzed. Contact times shall be in the range of 30 min to 1-2 hours and shall be determined in consultation with the EPA TOM. Environmental conditions shall be monitored but not controlled; however, care should be taken to avoid excessive flow over the coupons during the decontamination testing. The persistence of the Lewisite is not well characterized. If initial points within the test matrix show that there is no Lewisite remaining on the positive control, the TOM may adjust the remaining test matrix but shall ensure that the new test matrix has the same number of samples. The test matrix below shall yield 320 samples plus laboratory blanks. The contractor shall allow for 10 extra test matrix points (100 samples) for adjustments that may be needed during the testing.

**Table 1: Test Matrix for Lewisite Neutralization**

Decontaminant	Material	Contact Time	
		t <sub>1</sub>	t <sub>2</sub>
Decontaminant A	Sealed concrete	t <sub>1</sub>	t <sub>2</sub>
	Wood flooring material	t <sub>1</sub>	t <sub>2</sub>
	Galvanized metal ductwork	t <sub>1</sub>	t <sub>2</sub>
	Glass	t <sub>1</sub>	t <sub>2</sub>
Decontaminant B	Sealed concrete	t <sub>1</sub>	t <sub>2</sub>
	Wood flooring material	t <sub>1</sub>	t <sub>2</sub>
	Galvanized metal ductwork	t <sub>1</sub>	t <sub>2</sub>
	Glass	t <sub>1</sub>	t <sub>2</sub>
Decontaminant C	Sealed concrete	t <sub>1</sub>	t <sub>2</sub>
	Wood flooring material	t <sub>1</sub>	t <sub>2</sub>
	Galvanized metal ductwork	t <sub>1</sub>	t <sub>2</sub>
	Glass	t <sub>1</sub>	t <sub>2</sub>
Decontaminant D	Sealed concrete	t <sub>1</sub>	t <sub>2</sub>
	Wood flooring material	t <sub>1</sub>	t <sub>2</sub>
	Galvanized metal ductwork	t <sub>1</sub>	t <sub>2</sub>
	Glass	t <sub>1</sub>	t <sub>2</sub>

The decontaminants shall be identified by the EPA TOM based upon the solution decontamination testing and may be combinations of decontamination solutions. These decontaminants could potentially be in liquid, gel or foam form. The EPA TOM shall provide the methods for application of the liquid, gel or foam. These methods shall be based upon previous EPA testing.

Method development for the neutralization of these decontaminants may be required. The contractor shall consult with the EPA TOM on the design of this method development. The EPA TOM shall suggest neutralization agents that were successful in previous EPA or other's decontamination studies. The contractor shall anticipate 84 test coupon extracts in addition to laboratory blanks for this development study.

Ideally if a mass spectrometry method is selected for analysis of the Lewisite (all three forms) the contractor shall do the extract analysis in scan mode so that toxic by-products could potentially be identified. The effect of the decontaminants on the materials shall also be examined through visual inspection during these surface decontamination tests.

**TASK 4: EXAMINE TECHNOLOGIES FOR REMOVAL OF ARSENIC**

As stated above, when the Lewisite reacts to form less toxic (non-vesicant) compounds, the resulting products contain arsenic, a toxic metal. The contractor shall consult with the TOM to determine two (2) suitable methods for arsenic removal. These methods shall then be tested on two (2) sets of coupons of each material that was previously decontaminated (one contact time). These subsets of coupons shall be selected by the EPA TOM. Method development shall likely be required for this task because, typically, these removal technologies are applied over a larger scale. This test shall also be conducted with five (5) replicates of the test coupons, three (3) replicates of the positive controls, and two (2) replicates of procedural blanks for four (4) materials generating 160 samples to be analyzed for total arsenic.

**TASK 5: DRAFT FINAL REPORT**

The contractor shall draft a final report within eight (8) weeks after completing Task 4. The EPA TOM shall coordinate the peer review and QA review of the draft report and submit comments to the contractor for their response and products revision. The contractor shall respond to the comments from the peer reviewers and the EPA Quality Assurance officer within three (3) weeks after receipt of the comments.

**VI. DELIVERABLE SCHEDULE**

1. On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress, problems encountered, monthly and cumulative financial expenditures, and cost and schedule variance.
2. Bi-weekly conference calls shall be established between the EPA TOM and the contractor project officer. During these conference calls, the contractor shall report on progress made in the project and any technical issues encountered in implementation of the test plan.
3. Within 30 working days of the issuance of this Task Order, a Quality Assurance Project Plan (QAPP) shall be provided to the EPA, in both electronic format (Microsoft Word, and Adobe) and hard copy. The EPA TOM shall then coordinate EPA QA review of the QAPP. The contractor shall then address any comments resulting from these reviews within 30 days after receipt of the comments. The contractor shall then provide a final copy of the QAPP amendment both in electronic and hard copy for EPA Approval. Work covered in

Tasks 3 and 4 shall not begin until the QAPP amendment has been approved by the EPA Quality Assurance Manager. The QAPP amendment shall contain work plans detailing how the experiments shall be run and include a timetable for task completion. The contractor shall adhere to QA requirements as delineated in "Attachment #1" to this PWS.

4. Transfer of project data (including raw data) shall occur at the conclusion of each experiment within each task. The data sheets should also include the exact experimental conditions (e.g. temperature and relative humidity), operation conditions, raw peak areas from the mass spectra or spectroscopy (as applicable), the calibration data sets for the coupon extracts, and the measured agent concentrations on all of the coupons (test coupons, procedural blanks, positive controls, and laboratory blanks). The subsequent experiments shall not begin until the EPA TOM has reviewed and approved the data from the current task. The TOM shall provide the approval or disapproval within one (1) business day.
5. A draft final technical report shall be submitted within eight (8) weeks after the completion of the testing in Tasks 1 through 4 for all liquids and removal methods; thus only one (1) draft report shall be submitted under this PWS.
6. A single, final technical report shall be submitted that incorporates revisions based on comments from the peer reviewers, quality assurance reviewer and the EPA TOM. The final report is due within 30 calendar days after receipt of the comments.
7. A document describing any deviations from the QA plan shall also be provided along with the final report.

**Table 2. Deliverable Schedule in Summary**

Task Number	Deliverable	Due Date
1	Draft QAPP (in Microsoft Word and pdf form) for review by TOM and EPA QA Manager.	Within 30 days after award of task order.
1	QAPP (in Microsoft Word and pdf form) with TOM and QA comments incorporated and response to QA comments in table form.	Within 30 days after receipt of TOM and QA comments.
2, 3, 4	Project data and experimental conditions.	Within 10 business days after completion of task.
5	Draft technical report (in Microsoft Word and pdf form) that includes all data generated in Tasks 2, 3, and 4.	Within eight (8) weeks after completion of Tasks 1 through 4.
5	Final technical report with TOM, QA, and peer review comments incorporated. The response to peer and QA comments should be submitted in table format.	Within 30 days after receipt of all comments.

## VII. REPORTING REQUIREMENTS

1. Data and reports generated as a result of this effort shall be shared with the EPA TOM for internal EPA use.
2. Laboratory data shall be transferred electronically to the EPA TOM after the conclusion of each trial or series of tests. Raw data shall be included (specifically all conditions operational and environmental conditions, the raw peak areas from the mass spectra, and calibration data sets for the GC-MS of the coupon extracts).
3. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at [www.epa.gov/nhsr](http://www.epa.gov/nhsr) under the policy and guidance.

Field Code Changed

4. Prior to submission of the final data package, all of the data shall be given to the EPA TOM in electronic format (specifically Microsoft Excel spreadsheets). The data on these spreadsheets shall be straightforward and explanation of the results via comments shall be added if they are not straightforward.
5. Copies of internal audit reports and responses shall be sent to the EPA TOM in a timely fashion. The TOM and EPA Quality Assurance Manager should be immediately notified of any critical findings.
6. The contractor shall document all data analysis including statistical models and related assumptions.

**ATTACHMENTS**    Attachment 1: NHSRC Quality Assurance Requirements Form  
Attachment 2: NHSRC QA Requirements Definitions List

**SURVEILLANCE PLAN  
STREAMS II  
Task Order 0007, Battelle EP-C-11-038**

**TITLE:** Systematic Decontamination of Lewisite – Neutralization and Arsenic Removal

**Task Order Manager (TOM):** Emily Snyder

<b>Performance Objective (Task)</b>	<b>Performance Standard (PS)</b>	<b>Surveillance Plan (SP)</b>	<b>Contractor Incentive (CI)</b>	<b>✓ or X</b>
<b>Task 1:</b> Draft Quality Assurance Plan	Contractor drafts a quality assurance plan and revises as directed by TOM and EPA's quality assurance (QA) manager.	TOM and the EPA QA manager will review the quality assurance plan.	TOM will address compliance in PPE	x
<b>Task 2:</b> Method Development Lewisite and Total Arsenic	Contractor is able to show Extraction efficiencies 40%-120% with less than a 30% coefficient of variance for Lewisite and total arsenic for all materials.	TOM will examine extraction efficiency data upon receipt.	TOM will address compliance in PPE	x
<b>Task 3:</b> Perform Decontamination Efficacy Tests	Contractor runs all tests outlined in the test matrix and measures all data quality indicators outlined in QAPP. Data is delivered to TOM (raw data, percent recoveries and data quality indicators) periodically as indicated in PWS.	TOM will document whether receipt of data delivery is complete and timely.	TOM will address compliance in PPE	x
<b>Task 4:</b> Examine Technologies for Removal of Arsenic	Contractor runs all tests outlined in the SOW and measures all data quality indicators outlined in QAPP. Data is delivered to TOM (raw data, percent recoveries and data quality indicators) periodically as indicated in PWS.	TOM will document whether receipt of data delivery is complete and timely.	TOM will address compliance in PPE	x
<b>Task 5:</b> Draft Final Report	Contractor completes a draft of the final report. Contractor addresses TOM, QA and peer review comments.	TOM will provide comments on final report and document that the contractor has addressed all the TOM, QA and peer review comments.	TOM will address compliance in PPE	x